THURSDAY, NOVEMBER 7, 1912.

MATHEMATICAL TEXT-BOOKS.

(1) *A Treatise on Plane Trigonometry.* By Prof. E. W. Hobson, F.R.S. Third edition. Pp. xv+383. (Cambridge University Press, 1911.) Price 12*s.* net.

(2) *A Shorter Geometry.* By C. Godfrey, M.V.O., and A. W. Siddons. Pp. xxii+301. (Cambridge University Press, 1912.) Price 2*s.* 6*d.*

(3) *A New Geometry.* Books i–iii. By W. M. Baker and A. A. Bourne. Pp. xxii+122+iii. (London: G. Bell and Sons, Ltd., 1912.) Price 1*s.* 6*d.*

(4) *Lessons in Geometry.* Part i. By Dr. Charles McLeod. Pp. xii+212. (Aberdeen University Press, 1912.) Price 2*s.* 6*d.* net.

(5) *Examples in Arithmetic.* Part i., with answers. Taken from "A School Arithmetic." By H. S. Hall and F. H. Stevens. Pp. ix+115+xxii. (London: Macmillan and Co., Ltd., 1911.) Price 1*s.* 6*d.*

(6) *Solutions of the Examples in Godfrey and Siddons's "Solid Geometry."* By C. L. Beaven. Pp. 164. (Cambridge University Press, 1912.) Price 5*s.* net.

(7) *A B C of Hydrodynamics.* By Lieut.-Col. R. de Villamil. Pp. xi+135. (London: E. and F. N. Spon, Ltd.; New York: Spon and Chamberlain, 1912.) Price 6*s.* net.

(8) *A New Algebra.* By S. Barnard and J. M. Child. Volume ii. Containing Parts iv.–vi. Pp. x+301–731. (London: Macmillan and Co., Ltd., 1912.) Price 4*s.*

(9) *A Treatise on the Analytical Geometry of Three Dimensions.* By Dr. George Salmon, F.R.S. Revised by Reginald A. P. Rogers. Fifth edition. In two volumes. Vol. i. Pp. xxii+470. (London: Longmans, Green and Co.; Dublin: Hodges, Figgis and Co., 1912.) Price 9*s.*

(10) *Fergusson's Percentage Unit of Angular Measurement, with Logarithms; also a Description of his Percentage Theodolite and Percentage Compass.* For the use of Surveyors, Navigating Officers, Civil and Military Engineers, Universities and Colleges. By John Coleman Fergusson. Pp. lxvii+467. (London: Longmans, Green and Co., 1912.) Price 3*l.* 3*s.* net.

(11) *An Elementary Treatise on Statics.* By Prof. S. L. Loney. Pp. viii+393. (Cambridge University Press, 1912.) Price 12*s.*

(1) PROF. HOBSON'S treatise on plane trigonometry has for many years been regarded as the best work on the subject available for English students. There is probably no lecturer at Oxford or Cambridge who does not recommend his pupils to read it. In fact, before its publication it was necessary for those who wished for a rigorous treatment of those infinite series and products which occur in higher trigonometry to have recourse to French or German text-books. But recently much has been done in England to remedy this deficiency. Mr. Hardy's volume on "Pure Mathematics," Prof. Bromwich's work on "Infinite Series," and Prof. Hobson's "Theory of Functions of a Real Variable" are noteworthy examples. These, however, deal with a wider field, and students will still continue to gain their first insight into the problems of higher analysis from this volume.

The need of a third edition has given the author an opportunity for a complete revision; new matter has also been inserted. The theory of the measurement of circular arcs is discussed at some length in the opening chapter. Those who are interested in mathematical history will appreciate the section on the quadrature of the circle, in which is given a modified form of Gordon's proof that π is a transcendental number, thus establishing the impossibility of constructing by Euclidean methods a straight line bearing to a given straight line the ratio π. But the most important changes in the work are those which relate to the theory of series and products. Many additions have been made, further examples are given to illustrate the different cases that arise, and a number of references are supplied for those who wish to make a more thorough study of the subject. We have no doubt that this volume will retain its place as the standard text-book for many years to come.

(2) This volume is a carefully reasoned interpretation of the Board of Education circular on the teaching of geometry. The first stage aims at illustrating the fundamental concepts, the second leads to the discovery of the principal theorems, and the third builds up on this basis a deductive development of the subsequent propositions. The authors feel that too much time has in the past been devoted to purposeless drawing, and have therefore omitted much of the experimental work contained in their previous treatise; the number of theoretical exercises, on the other hand, has been increased. We shall be much surprised if this text-book is not widely used.

(3) This is an abbreviated form of the text-book on elementary geometry by the same authors published nine years ago. The only important change is the redistribution of the propositions in Book i., those on congruent triangles being now

grouped together. The supply of riders, particularly in connection with angle properties of the circle, seems rather inadequate. We are glad to see that limit methods of proof are employed for the fundamental tangent properties.

(4) There are several novel features in this textbook. It is divided into thirty-five sections, each of which professes to contain the material for one lesson; but we are inclined to think some of these sections will occupy four or five hours if an adequate amount of time is assigned to rider work. The theorems are not numbered, and no references to previous propositions are given in the proofs; a conversational method is employed which for beginners possesses obvious advantages, and the order of the theorems differs from that usually followed. The scope of the work includes the first three books of Euclid, the properties of similar figures, and the fundamental propositions of solid geometry. We are of opinion that the character of the book will render it more useful to the teacher than to the student.

(5) In order to meet the wishes of those teachers who prefer to take all book-work orally, the authors have now issued in a separate form the exercises contained in their "School Arithmetic." The work is published in two parts, the first of which deals with fractions, decimals, factors, compound quantities, and unitary method. Both in quality and variety the collection of examples is admirable.

(6) Many teachers will be glad to hear that the solutions of the exercises in Godfrey and Siddons's "Solid Geometry" have now been published. Where we have tested them we have found that they are set out very clearly. Mr. Beaven has avoided the temptation to which in such cases writers often succumb of allowing a desire for brevity to obscure lucidity of expression. The figures which illustrate the solutions of the problems on plan and elevation are drawn with great care, and the methods employed are fully explained.

(7) This is in no sense a text-book on hydrodynamics. A few formulæ are quoted from various mathematical treatises, but no proofs are given. The purpose of the author is to introduce the student to the ideas of the subject, and to point out the rather arbitrary conditions under which, in the present state of knowledge, the mathematician is compelled to work. We do not think that the novice will find the contents of this volume at all easy to understand and coordinate with his other scientific reading. The number of quotations from many different authorities and the variety of topics alluded to may well tend to confuse those who have little previous knowledge of the subject. In the hands of a skilled lecturer we think the material of this book and the lines of thought indicated would interest and stimulate a class of students of ordinary ability. The character of the work leads us to believe that the author's purpose would be achieved with a real measure of success by oral methods.

(8) The authors of this treatise have succeeded in producing a work wholly unlike any other textbook on the subject with which we are acquainted. They take as their motto a pregnant sentence from Tannery's "Leçons d'algèbre et d'analyse":—"J'ai horreur d'un enseignement qui n'est pas toujours sincère; le respect de la vérité est la première leçon morale, sinon la seule, qu'on puisse tirer de l'étude des sciences." Their contention is that the average schoolboy is fully capable of realising the fundamental ideas upon which the science of algebra and, in fact, all analysis is based, and that a powerful educative instrument is discarded if no attempt is made to discuss the base-principles of the subject. They regard rigour in fundamentals as important as variety in application, and the power to understand the meaning of a process as more valuable than the ability to apply it.

With these ideas in the abstract few people will disagree, but the majority of teachers hold that work of this character must be reserved for specialists. They consider that the mental calibre of the ordinary schoolboy, and the limited time at his disposal, are scarcely adequate to permit of the high standard required by the authors of this work. Great things can, of course, be done by an enthusiastic and able teacher; and we have no doubt at all that Mr. Barnard obtains excellent results at Rugby by following the lines here indicated. But we question whether the ordinary teacher could be expected to meet with success. We have not the space to comment in any detail on the contents of this volume, but we would urge teachers to procure a copy and study it for themselves. They will find in it much that is highly suggestive, and will gather from it a number of new ideas. It is in every respect a remarkable work.

(9) By the direction of the Board of Trinity College, Dublin, a new edition of Dr. Salmon's treatise on analytic geometry of three dimensions has been prepared. The editor has retained the substance of what appeared in the fourth edition, but has brought it into line with more recent work by inserting a number of new sections; the list of references has also been supplemented. Among the additions that have been made we note some excellent plates showing models of the various species of quadrics, a paragraph on Fiedler's pro-

jective coordinates, an account of the parametric representation of twisted cubics and quartics, Staude's elegant thread construction for confocal ellipsoids, and considerable reference to the later results obtained in differential geometry. There are a large number of minor changes, but the numbering of articles and chapters remains unaltered. Mr. Rogers is to be congratulated on the way in which he has executed a far from easy task.

(10) The author claims that the method explained in this volume abbreviates and simplifies very materially the work of surveyors and navigators. It is, of course, impossible for us to judge from a perusal of the book how far the theodolite which Mr. Fergusson has invented is successful in practical work. But Prof. Heath states that it has been tested in the engineering department of Birmingham University, and has proved extremely convenient. He also remarks that

> "the reduction of the results of observations can be carried on simultaneously with the field work without reference to books of tables, thus giving the surveyor full information about any part of the field observed, while he is on the spot. For all traverse surveying, especially for rapid preliminary traverse, subject to modification, the instrument possesses distinct advantages over the ordinary theodolite."

The fundamental idea in the construction of the instrument lies in the method of graduation. To explain the system adopted, we will suppose that OA_0, OA_{100} are two radii of the circle, containing an angle of 45°. Then points $A_1, A_2, \ldots A_r \ldots$ are marked on the rim such that the tangent of the angle A_rOA_0 is equal to $r/100$, where r takes all values from 1 to 100. By this means it is clear that the observer, instead of reading off the angle, obtains its tangent, which is more useful for his purpose. As a matter of fact, the new form of theodolite is also graduated in degrees so that the angle can also be obtained, if desired. The angle A_1OA_0 is taken as unit, and is called the one per cent. angle.

The first fifty pages explain very fully the theory, and numerous examples are given to show its application. The remaining 450 pages are occupied with tables, to the compilation of which the author has given nineteen years. The leading column gives the angle in the percentage form at intervals of 0·001 per cent. below 1 per cent., and of 0·01 per cent. above it. The other columns give logarithmic sines, cosines, tangents, secants with difference tables to seven places of decimals, and the angle in degrees to 0·001 of a second. A shorter table at the end contains tangents of half angles and versines. It seems almost incredible that any one man should have been able to carry through, almost single-handed, such a laborious work as Mr. Fergusson has accomplished. It undoubtedly merits the serious consideration of those engaged in survey work. The bulky size of the volume gives it rather an alarming appearance, but the processes are in reality very simple, and a single hour's work with the instrument would probably be enough to enable any practical man to gauge its utility.

(11) There is a distinct need for a treatise on statics suitable for candidates for entrance scholarships at the universities. A number of excellent introductory text-books exist, but with two possible exceptions we do not know of any work which exactly meets this demand. Many teachers will therefore welcome the publication of Prof. Loney's book, which may be regarded as a companion volume to his "Dynamics of a Particle and of Rigid Bodies," recently issued. It is assumed that the student possesses some knowledge of the methods of the calculus and the elements of analytical solid geometry. In addition to the ordinary elementary course, it contains chapters on shearing stresses, three-dimensional forces, wrenches, chains, attractions and potential, and slightly elastic beams. There is an excellent collection of examples, including some of very considerable difficulty. The author has the rare gift of writing simply, and he has chosen his material with the same skill that characterises his previous work.

PHILOSOPHY AND PSYCHOLOGY.

(1) *Scientific Method: its Philosophy and its Practice.* By F. W. Westaway. Pp. xxi+439. (London: Blackie and Son, Ltd., 1912.) Price 6*s*.

(2) *Proceedings of the Aristotelian Society.* New Series. Vol. xii. Containing the Papers read before the Society during the Thirty-third Session, 1911–1912. Pp. ii+345. (London: Williams and Norgate, 1912.) Price 10*s*. 6*d*. net.

(3) *Anales de Psicologia.* Trabajos del año 1910. Volumen ii. Pp. 360. (Buenos Aires: *La Semana Médica.* Imp. de Obras de E. Spinelli, 1911.)

(1) AN excellent book for science teachers and for the general reader who wishes to acquaint himself with scientific method. Beginning with the consideration of words and the importance of exactness in their use, Mr. Westaway enters on a sketchy history of philosophy, dealing with Plato, Aristotle, Bacon, Descartes, Locke, and Hume. Thence he proceeds to logic,